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APPLICATION FOR LETTERS PATENT

TITLE: DIGITAL PHOTOGRAPHING APPARATUS

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Digital Photographing Apparatus

Field of the Invention

The present invention relates to a digital
photographing apparatus for photographing a picture
such as a still picture or a moving picture, recording
the photographed picture to a record medium,
reproducing a picture from the record medium, and
displaying the reproduced picture.

Description of the Related Art

As an example of a digital photographing
apparatus, a digital still camera that obtains position
information (latitude and longitude) of the position at
which a picture was photographed (hereinafter the
position is referred to as photographed position), and
records the position information along with picture
data to the record medium. When picture data is
reproduced from a record medium and displayed, the
position information is displayed as numeric values on
a reproduced picture screen. However, with the numeric
values of latitude and longitude, it is difficult for
the user to know where the picture was photographed.

To reproduce picture data recorded by a
digital still camera, a picture reproducing apparatus
composed of a map database, a displaying device, and a
system controller is used along with the digital still
camera. The digital still camera records picture

information and position information of the
photographed position thereof. When the picture
information photographed by the digital still camera is
displayed, the photographed position is displayed on a
5   map so that picture information can be searched
corresponding to the photographed position. Such a
technology is disclosed in Japanese Patent Laid-open
Publication No. 9-252454.

According to the related art reference, a
10   picture reproducing apparatus is required in addition
to a digital still camera. Thus, the digital still
camera has only functions for recording picture
information and position information. Moreover, the
digital still camera has restrictions about the
15   performance of the CPU and the storage capacity of the
memory. Thus, it cannot quickly perform a process for
reading position information from a record medium and
displaying icons thereof on a map picture.

20   OBJECTS AND SUMMARY OF THE INVENTION
Therefore, an object of the present invention
is to provide a portable digital photographing
apparatus that allows a picture to be recorded,
reproduced and quickly and easily iconized on a map.
25   The present invention is a digital
photographing apparatus, portably structured, for
recording a photographed digital picture signal to a

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record medium and reproducing a digital picture signal
from the record medium, comprising a photographing
means for photographing a picture and outputting a
picture signal, a signal processing means for
5   processing the picture signal supplied from the
photographing means, a position information obtaining
means for obtaining position information, a displaying
means for displaying the digital picture signal
supplied from the signal processing means, a recording
10   means for recording the digital picture signal supplied
from the signal processing means and the position
information supplied from the position information
obtaining means to the record medium, a reproducing
means for reproducing the digital picture signal and
15   the position information from the record medium, a map
information obtaining means for obtaining map
information, a table creating means for creating a
table for the reproduced position information, and a
controlling means for referencing the table for the
20   position information and displaying an icon
corresponding to the position information and the map
information to the displaying means.

     According to the present invention, in a
digital photographing apparatus that allows a
25   photographed picture to be displayed and recorded on a
record medium and a picture reproduced from the record
medium to be displayed, an icon corresponding to

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obtained position information can be displayed on a map. Thus, with the digital photographing apparatus, when the user selects an icon as position information of the photographed position of a desired picture, the picture can be displayed. In addition, since a table for reproduced position information is created, such a process can be quickly and easily performed.

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of a best mode embodiment thereof, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the structure of an embodiment of the present invention;

Fig. 2 is a schematic diagram showing the file structure of a memory card according to the embodiment of the present invention;

Fig. 3 is a schematic diagram showing an example of data of position information based on the POIX according to the embodiment of the present invention;

Fig. 4 is a schematic diagram showing definitions of category code according to the embodiment of the present invention;

Fig. 5 is a schematic diagram showing an

example of the data format of a compressed picture file
according to the embodiment of the present invention;

Fig. 6 is a flow chart for explaining a
process for creating a table of position information
according to the embodiment of the present invention;

Fig. 7 is a schematic diagram showing an
example of a created table;

Fig. 8 is a flow chart for explaining an icon
displaying process according to the embodiment of the
present invention;

Fig. 9 is a schematic diagram showing an
example of a map displayed according to the embodiment
of the present invention;

Fig. 10 is a schematic diagram showing an
example of a displayed picture for explaining the icon
displaying process according to the embodiment of the
present invention;

Fig. 11 is a flow chart for explaining a
process for selecting an icon and displaying a picture
linked to the selected icon according to the embodiment
of the present invention;

Fig. 12 is a schematic diagram showing an
example of a displayed picture for explaining the icon
selecting process according to the embodiment of the
present invention;

Fig. 13 is a schematic diagram showing an
example of scroll and decide keys according to the

embodiment of the present invention;

Fig. 14 is a schematic diagram showing an example of a displayed picture for explaining the icon selecting process according to the embodiment of the present invention; and

Fig. 15 is a schematic diagram showing an example of a picture linked to a selected icon according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Next, an embodiment of the present invention will be described. The embodiment of the present invention is a digital still camera. Fig. 1 shows the system structure of the embodiment. In Fig. 1, reference numeral 101 is a CCD (Charge Coupled Device). The CCD 101 outputs an object image as a photograph signal through a lens portion. The photograph signal is supplied to a picture processing circuit 102.

The picture processing circuit 102 comprises a camera signal processing portion, a memory controller, a picture compressing/decompressing portion, a display picture buffer, and a D/A converter. The camera signal processing portion includes a clamping circuit, a luminance signal processing circuit, a contour compensating circuit, a defect compensating circuit, an automatic aperture controlling circuit, an automatic focus controlling circuit, and an

automatic white balance compensating circuit. A
display picture buffer memory and a data transmission
path 109 are connected to the memory controller. An
output signal of the display picture buffer memory is
supplied to a picture displaying device 103 through a
D/A converter.

The picture compressing/decompressing portion
compresses picture data corresponding to for example
the JPEG (Joint Photographic Experts Group) format. In
addition, the picture compressing/decompressing portion
decompresses compressed picture data. The picture
displaying device 103 is structured as a displaying
device such as an LCD (Liquid Crystal Display) built in
the camera. A picture signal is supplied from the
picture processing circuit 102 to the picture
displaying device 103. Thus, a picture that is being
photographed is displayed on the picture displaying
device 103. In addition, a picture that is read from a
removable record medium such as a memory card 108 is
displayed.

A DRAM (Dynamic Random Access Memory) 104, a
controlling microcomputer 105, and a memory card
controller 107 are connected to the data transmission
path 109. The memory card controller 107 writes and
reads data to/from the memory card 108. The memory
card 108 contains a flash memory, a buffer memory, and
a memory controller. The memory card 108 is attachable

and detachable to/from the digital still camera main body. The record medium is not limited to the memory card. In other words, a floppy disk, a rewritable optical disc, or the like can be used.

A scale up switch 111, a scale down switch 112, and a scroll - decide key set 113 are connected to the controlling microcomputer 105. Besides those switches, other operator's switches such as a shutter button and an operation mode setup switch (not shown) are disposed. The scale up switch 111 is used to enlarge the size of a picture displayed on the picture displaying device 103. For example, whenever the scale up switch 111 is pressed, the size of the picture is enlarged by 10 %. In contrast, the scale down switch 112 is used to reduce the size of a picture displayed on the picture displaying device 103. Likewise, whenever the scale down switch 112 is pressed, the size of the picture is reduced by 10 %. According to the embodiment of the embodiment, the scale down switch 112 is used to reduce the size of an enlarged picture. The minimum size of a picture is the regular picture size.

Position information (the latitude and longitude of the current positon) is supplied from a GPS unit 106 to the controlling microcomputer 105 through a serial interface 110. The GPS unit 106 receives radio waves from a plurality of GPS satellites and calculates the latitude and longitude of the

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current positon. The GPS unit 106 generates valid longitude information and latitude information at intervals of for example one second.

When the user presses the shutter button, a picture signal photographed by the CCD 101 is supplied to the picture processing circuit 102. The picture processing circuit 102 processes the picture signal. The resultant picture signal is stored to the DRAM 104 under the control of a memory controller of the picture processing circuit 102. In addition, when the shutter button is pressed, the GPS unit 106 measures the latitude and longitude of the current position (namely, the photographed position). The measured latitude and longitude information is supplied from the GPS unit 106 to the DRAM 104 through the serial interface 110 of the controlling microcomputer 105 and the data transmission path 109. The DRAM 104 stores the latitude and longitude information.

When the photographed original picture data is stored to the DRAM 104, the original picture data is compressed by the picture compressing/decompressing portion of the picture processing circuit 102 under the control of the controlling microcomputer 105. The compressed picture data (JPEG data) is stored to the DRAM 104. AT that point, the compressed picture data is stored to a particular area different from the area for the original picture data. The compressed picture

data that is read from the DRAM 104 under the control of the controlling microcomputer 105 is written to the memory card 108 through the memory card controller 107.

When a picture such as a still picture stored in the memory card 108 is reproduced, the compressed picture data is read from the memory card 108 through the memory card controller 107. The compressed picture data is decompressed by the picture compressing/decompressing portion of the picture processing circuit 102. The decompressed picture data is written to the DRAM 104. The picture data stored in the DRAM 104 is displayed on the picture displaying device 103 through the picture processing circuit 102.

The memory card 108 has a file structure as shown in Fig. 2. Referring to Fig. 2, the memory card 108 has directories of a still picture directory (DCIM), a moving picture directory (MOxxxnn), a voice directory (VOICE), a control directory (AVCTL), a music directory (HIFI), and a position information directory (POSITION). Each directory has sub directories. For example, the still picture directory (DCIM) has sub directories such as msdcf. When a still picture is photographed by the digital still camera and the still picture is compressed corresponding to the JPEG format, the still picture is assigned dsc00001.jpg as a file name and an extension and stored to the sub directory msdcf.

The position information directory has sub
directories Poix (position information data), Route
(route data), track (track data), MAP (map data), and
so forth. When a still picture is photographed by the
digital still picture, position information of the
photographed position thereof is stored to a file
dsc0001.poi or the like that is placed below the sub
directory Poix. In this case, the extension poi
represents that the file is based on the POIX. One
position information file contains information of one
position. Likewise, one MAP file contained in the sub
directory MAP is composed of data of at least one map.
Map data is downloaded from a car navigation system, a
map database, or the like to the memory card 108.

The controlling microcomputer 105 pre-detects
the file structure of the memory card 108. When
photographed still picture data is written to the
memory card 108, the controlling microcomputer 105
assigns a file name to the still picture data. In
addition, when desired still picture data is read from
the memory card 108, the controlling microcomputer 105
designates the file name of the still picture data to
be read.

As was described above, when the shutter
button is pressed, the position information (latitude
and longitude) of the photographed position is written
to the DRAM 104. The position information is written

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to the memory card 108 through the memory card controller 107 under the control of the controlling microcomputer 105. When position information is recorded to the memory card 108, there are two methods.

5   As a first method, the position information is recorded as a file different from a picture file. As a second method, the positon information is directly recorded to a picture file.

       As an example of the first method, a position
10   information file in a data format based on the POIX (Point Of Interest eXchange language) is used. The POIX is a data format that was established by MOSTEC (Mobile Information Standard TEchnical Committee) so as to exchange position information on the Internet. The
15   POIX is a markup language based on the XML (eXtensible Markup Language) of which data is hierarchically structured using tags. The position information represents information of an objective position and information thereabout.

20   In other words, the position information is converted into a position information file in the data format based on the POIX under the control of the controlling microcomputer 105. The position information file is recorded as a file to the sub
25   directory Poix of the memory card 108. A picture file name to be linked can be described in a position information file. Thus, a file of a photographed

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picture and position information of a photographed position can be linked.

Fig. 3 shows an example of a data position information file based on the POIX. The data position information file is created by the controlling microcomputer 105. Referring to Fig. 3, a portion of first three lines (denoted by portion 11) describes a version number of the POIX for use. The portion 11 also describes a version number of a particular extension (sonypoix) proposed by the applicant of the present invention. A portion of the next five lines (portion 12) describes elements of the format. The elements of the format represent that the geodesic system (datum) used in the POIX is (tokyo: Japan geodesic system), that the coordinate system (unit) is (degree), and that the date and time of information creation is October 20, 1999, 10:35:47 + 09:00 (time zone). In addition to those elements, the format defines an altitude, a traveling state of a mobile substance, a traveling direction, a sequence of locus coordinate points, an object name, a description of the object, an accessing method to the object, a start point, an arrival point, a route from the start point to the arrival point, and the name of the distributer.

A portion of the 10-th and 11-th lines (portion 13) describes a search index (index pos) for each element of POI (Point Of Interest) that follows.

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In other words, the portion 13 describes an index having redundant position information of information (latitude and longitude) of an objective position.

A tag of the search index contains position information (latitude and longitude), the category of information, the distinguishment of a mobile substance or a non-mobile substance, and a geodesic system. In the example shown in Fig. 3, the position is at latitude 35.62222° N and longitude 139.74528° E; the category code is 14000000; the mobile/non-mobile distinguishment is non-mobile (fix); and the geodesic system is (tokyo). The number of digits of each of latitude and longitude is fixed. In the POIX format, the degree notation or the degree-second-minute notation can be selected. However, in the index, the degree notation is fixedly used. Since the number of digits and the notation are fixed, the index can be quickly read and converted into the internal format of the apparatus.

A portion of the next 11 lines (portion 14) describes POI information. In the portion 14, the representative position (point) of an object is denoted by the position (pos). The position is represented with latitude (lat) and longitude (lon). As described above, the portion 14 describes the same position as that in the index. A tag (image ref) describes a link position and a file name of a picture file to be linked

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to the POI. The file name is based on the directory
structure of the above-described memory card. A tag
(comment) describes a character string of a comment of
a picture linked to the POI. In the example shown in
Fig. 3, the tag (comment) represents the model name of
the digital still camera that photographed the picture.

A portion of the next line (portion 15)
describes the category of the POI. A portion of the
next line (gpstime) (portion 16) describes the date and
time on/at which time information is received from GPS
satellites. As shown in Fig. 4, the category is a
four-byte code of a character string in hexadecimal
notation. The first byte of the category code
describes a large category. A category code (14000000)
shown in Fig. 3 describes position information of a
photographed (recorded) position. Using the category
code, the shapes of icons can be varied for the
individual categories.

In the method of which position information
is directly recorded to a picture file and then stored
to the memory card 108, for example a header of Exif is
used. In other words, when the controlling
microcomputer 105 adds a header to an Exif format
picture file that has been compressed corresponding to
the JPEG format, the controlling microcomputer 105
records the position information stored in the DRAM 104
to a GPS information area of the header.

Fig. 5 shows the structure of an Exif format compressed data file. Although the detail explanation is omitted, an application marker segment (APP1) is preceded by a compression data start SOI. The APP1 contains an APP1 marker, an Exif identification code, and additional information. The JPEG standard defines that the size of the APP1 does not exceed 64 kilobytes. The additional information contains GPS IFD. The GPS IFD is used to describe GPS information including the latitude and longitude of position information and date and time on/at which the position information was obtained.

Next, processes according to the embodiment of the present invention will be described. In other words, processes for reproducing map information, a picture file, and position information of a photographed position from the memory card 108, displaying the map picture on the picture displaying device 103, and displaying an icon at a position corresponding to the position information on the map are performed. Those processes are performed by the controlling microcomputer 105.

First of all, a position information table that contains the position information of pictures stored in the memory card 108, the file numbers of the pictures, and additional information such as the categories of the pictures is created corresponding to

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a flow chart shown in Fig. 6. Before or after the
position information table is created, map picture data
is read from the memory card 108 through the memory
card controller 107 and stored to the DRAM 104. The
map picture data is read from the DRAM 104 and supplied
to the picture displaying device 103 through the
picture processing circuit 102. The map picture data
is displayed on the picture displaying device 103. The
map picture data contains range information. The range
information represents the latitude and longitude of
each corner of the square of the map.

As with the position information, a range
information file may be created. Alternatively, range
information may be directly recorded to a map picture
file. In addition, as with the position information,
the range information file may be contained in a POIX
file. Alternatively, the range information may be
written to the header of a picture file.

In the process shown in Fig. 6, the number of
pictures (n) stored in the memory card 108 is obtained
(at step S1). Thereafter, it is determined whether
there is a picture (file) that has not been processed
and the number of pictures (n) is larger than 0. When
the determined result at step S2 is No (namely, there
is no picture that has not been processed or the number
of pictures (n) is 0), the table creating process is
completed (at step S5).

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When the determined result at step S2 is Yes (namely, there is a picture that has not been processed and the number of pictures (n) is larger than 0), the flow advances to step S3. At step S3, one picture or a position information file is read from the memory card 108. When position information is written to the header of a picture file in the data structure shown in Fig. 5, the position information can be read along with the picture file. When a position information file is recorded in the data format corresponding to the POIX (see Fig. 3), the position information file is read.

At step S4, necessary information such as position information is extracted from the picture file or the position information file and registered to the table. In the case of the position information file as shown in Fig. 3, with reference to only the index, position information and so forth can be quickly extracted. The data extracting operation is performed for all picture fiels recorded in the memory card 108.

Fig. 7 shows an example of a table stored in the RAM of the controlling microcomputer 105. In Fig. 7, position information and so forth of each of five positions are contained in the table. In Fig. 7, reference numerals 21 and 22 represent the latitude and longitude of position information (degree-minute-second notation or decimal notation), respectively. In Japan, reference numerals 21 and 22 represent values of north

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latitude and east longitude, respectively. Reference
numeral 23 represents a category code. Reference
numeral 24 represents a file name of a picture file
containing position information. A category code
(14000000) shown in Fig. 7 represents a category of
photographed positions. A category code (04000000)
represents a category of sightseeing spots and
historical spots. A category code (05000000)
represents a category of stores. (Dsc) of a file name
of a position information file represents position
information obtained whenever the shutter of the
digital still camera is pressed. An extension (jpg)
represents a file of which data has been compressed
corresponding to the JPEG format.

After the table has been created, icons are
displayed corresponding to latitude and longitude
information contained in the table corresponding to a
process shown in a flow chart of Fig. 8. At that
point, with the scale up switch 111 and the scale down
switch 112, the size of the map can be enlarged and
reduced, respectively. At step S11, the display area
of the map is obtained corresponding to the range
information, the enlargement ratio, and the reduction
ratio of the map.

At step S12, it is determined whether or not
there is a position information table that has not been
processed. When the determined result at step S12 is

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No (namely, there is no position information table that has not been processed), the flow advances to step S17. At step S17, the icon displaying process is completed and then the icon selecting process is performed. When the determined result at step S12 is Yes (namely, there is a position information table that has not been processed), the flow advances to step S13. At step S13, position information (latitude and longitude) of one picture is read from the table. The data of one line shown in Fig. 7 is position data of one picture.

At step S14, it is determined whether or not the position data is in the display range of the map obtained at step S11. When the determined result at step S14 is No (namely, the positon data is not in the display area), an icon is displayed (at step S16). When the determined result at step S14 is Yes (namely, the positon data is in the display area), the flow advances to step S15. At step S15, an icon is displayed on the map. In reality, at step S14, the latitude or longitude of each corner of the square of the display range is compared with latitude or longitude of the position information. The loop from step S12 to step S16 is repeated for all position data of the position information table.

Fig. 9 shows an example of a map picture displayed on the picture displaying device 103. A dotted square area 31 in the vicinity of the center of the map

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picture is an icon selection area. In the process shown in Fig. 8, for example, icons 32a to 32e corresponding to five positions of the table are displayed on the map as shown in Fig. 10. In Fig. 10, small black squares are icons corresponding to latitude and longitude data contained in the table. It should be noted that the icons may be displayed in another shape. Alternatively, the icons may be displayed in different shapes corresponding to categories of the category code. Once the position information is created, even if map information is changed, the process for creating the table shown in Fig. 9 can be omitted.

While the icons 32a to 32e are displayed on the map, a desired icon is placed at the closest position to the center of the selection area 31. Thus, the desired icon is selected. A picture linked to the selected icon is displayed on the picture displaying device 103. Next, with reference to Fig. 11, the icon selecting process and the picture displaying process will be described.

First of all, at step S21, the number of icons (m) in the selection area 31 is obtained. At step S22, it is determined whether or not the number of icons (m) is larger than 0 (namely, m> 0). When the determined result at step S22 is Yes (namely, m > 0), the flow advances to step S23. At step S23, an icon at

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the closest position to the center of the display
screen is obtained. To place a desired icon
(photographed position) in the selection area 31 or the
center thereof, the scale up switch 111, the scale down
5   switch 112, and the scroll - decide key set 113 are
used.

Fig. 13 shows an example of the scroll -
decide key set 113 composed of a scroll key 113a and a
decide key 113b. The scroll key 113a has arrows. With
10   the scroll key 113a, the display screen can be scrolled
in any direction. The decide key 113b is disposed at
the center of the scroll key 113a. When the decide key
113b is pressed, the icon selecting process is
completed and a picture corresponding to the selected
15   icon is displayed.

The display area of the picture displaying
device 103 of the portable photographing apparatus such
as a digital still camera is narrow. To allow the user
to more easily see a map that is displayed, he or she
20   presses the scale up switch 111. Fig. 12 shows an
enlarged picture. In this example, even if the map is
enlarged, the positions of the icons 32a to 32e do not
vary on the map. Thus, even if the display area is
narrow, the user can accurately or fully know a desired
25   position on the map. In the example shown in Fig. 12,
no icon is displayed in the selection area 31. In that
case, an icon cannot be selected. Thus, the flow

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advances to step S28. At step S28, the process is completed.

Using the scale up switch 111, the scale down switch 112, and the scroll - decide key set 113, the user places a desired icon in the selection area 31. When the selection area 31 contains a plurality of icons, the desired icon is placed at the closest position to the center of the selection area 31. In an example shown in Fig. 14, with the switches and keys, the icon 32a is placed in the selection area 31. In the example, when the user presses the decide key 113b, the icon 32a is selected.

At step S24 shown in Fig. 11, to notify the user that the icon 32a has been selected, the icon 32a is highlighted against other icons. For example, the color of the selected icon is varied. Alternatively, the selected icon is blinked. Alternatively, the selected icon may be displayed in a reverse color. Thereafter, the flow advances to step S25. At step S25, the apparatus prompts the user for input data.

At step S26, it is determined whether or not the decide key 113b has been pressed. When the determined result at step S26 is No (namely, the decide key 113b has not been pressed), the flow advances to step S28. At step S28, the process is completed. In reality, when the decide key 113b has not been pressed for a predetermined time period, it is determined that

the decide key 113b has not been pressed.
Alternatively, besides the decide key 113b, a cancel
key may be disposed. When the determined result at
step S26 is Yes (namely, the decide key 113b has been
pressed), the flow advances to step S27. At step S27,
a picture linked to the selected icon is displayed on
the picture displaying device 103 instead of the map.
Fig. 15 shows the state of which a picture linked to
the selected icon 32a is displayed.

An icon at the current position may be
displayed on the map. In that case, a map that
contains range information is displayed so as to obtain
position information from the GPS unit. When the
obtained position information is in the display range,
an icon that represents the current position is
displayed on the map. Thus, the user can use the
apparatus as a navigation system.

According to the above-described embodiment,
as a means for obtaining position information, the GPS
is used. Alternatively, another means such as a
position information service of a cellular phone may be
used. Alternatively, the user may designate the
current position with a map displayed on the displaying
device. In addition, without a means for obtaining
position information, a table for displaying icons
using position information that is read from a data
record medium may be created. Moreover, position

information and map information may be obtained from a map database through a communication network. Obtained map information may be hierarchically structured.

The above-described embodiment is a digital still camera. Likewise, the present invention can be applied to a digital photographing apparatus that photographs a moving picture. As long as position information is described in a predetermined data format, the present invention can be applied to other than the POIX data format. In addition, the present invention can be applied to other than the Exif format as a picture file format.

As described above, according to the present invention, a picture and position information are recorded to a record medium such as a memory card. A picture and position information are reproduced from the record medium. An icon corresponding to the position information is displayed on a map. Thus, position information of a picture such as a photographed position can be clearly displayed without a connection to another device. Thus, photographed pictures can be easily managed. In addition, according to the present invention, since position information is stored as a table, a process for displaying icons can be quickly and easily performed.

Although the present invention has been shown and described with respect to a best mode embodiment

thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions, and additions in the form and detail thereof may be made therein without departing from the spirit

5   and scope of the present invention.